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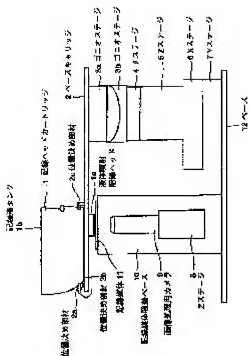
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(54) INSPECTION EQUIPMENT FOR RECORDING HEAD SUCH AS LIQUID JET RECORDING HEAD, HITTING POINT INSPECTION METHOD AND MANUFACTURE THEREOF, LIQUID JET RECORDING HEAD, AND LIQUID JET RECORDER MOUNTING IT



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a hitting point inspecting method for recording head and a recording head inspection equipment in which the hitting position of a liquid drop being ejected from a liquid jet recording head and the ejection opening position can be observed and the ejection angles of a main drop composing the liquid drop and a satellite can be measured.

SOLUTION: At least one liquid drop ejected from the ejection opening of a recording head 1a held on a base carriage 2 hits against a recording medium 11 spaced apart from the ejection opening face. Liquid drops hitting the ejection opening and the recording medium 11 are recognized by an image processing camera 9 located under the recording medium 11 and then subjected to image processing. Subsequently, coordinates thereof are measured and the horizontal and vertical distances between them

are calculated by image recognition coordinate difference. Finally, ejection angles of a main drop and a satellite composing the liquid drop are calculated based on the calculated distances. The calculated data is fed back to a recording head manufacturing process or stored in the recording head.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]In recording heads, such as a liquid jet recording head which carry this invention in the liquid jet recorder which breathes out recording ink, such as ink, and records on a recording medium, and can breathe out recording ink and to which it closes, Recording head test equipment which measures the impact position of the drop breathed out from the dot pattern and liquid jet recording head of a recording head, and inspects the printing performance of a recording head without carrying in a recording device body,

It is related with the liquid jet recorder which can carry the liquid jet recording head impact-area inspection method, the manufacturing method of a liquid jet recording head, the liquid jet recording head, and this recording head which measure the discharging angles of the main drop which measures the impact position of the drop breathed out and constitutes a drop, and a satellite.

[0002]

[Description of the Prior Art]As a recorder which records to recording media (only henceforth a recording form), such as paper, cloth, a plastic sheet, and a sheet for OHP, conventionally, What carries the recording head using various recording methods, for example, wire dot method, thermal recording, hot printing methods, or fluid injection record (ink jet) methods etc. is proposed. About the liquid jet recorder (ink-jet recording device) using a fluid injection recording method, among these. The output means of an information processing system, for example, a copying machine, a facsimile, an electronic typewriter, It is used as the handicap or portable printer provided in the printer as printing terminals, such as a word processor and a workstation, or a personal computer, a host computer, a disk unit, a video device, etc., and is commercialized.

[0003]And to the recording head of a liquid jet recorder. As a discharge energy generation element for carrying out the regurgitation of the recording ink from a delivery, The thing which irradiates with electromagnetic waves, such as a thing using electric machine conversion bodies, such as a piezo-electric element, and laser, makes them generate heat, and makes recording ink breathe out in the operation by this generation of heat, or the thing which makes recording ink heat and makes a drop breathe out by the electric heat transfer device which has a heating resistor is used.

[0004]In the liquid jet recorder, these days, it becomes a situation where the output of a color picture is called for by progress of software and a computer, and the liquid jet recording head is also performing color correspondence according to this situation. And the method performed as a means to realize this now is a multicolor head by the assembly of a monochrome head.

A multicolor head also exists depending on the manufacturing method of a head. It is also possible to double storage density as a head unit by, concrete for example, making the same kind of head unit counter, Ink different, respectively is made to correspond to the head unit made to counter or arrange in parallel, and attaining high definition color printing and a waterproof picture is also performed.

[0005]In addition to the situation of such colorization, highly minute-ization of the generating picture is also called for, and in a fluid injection recording method, it is more highly minute at the densification of print density, or the concentration change of recording ink, and is going to realize high definition.

[0006]In order to form a picture [that it is highly minute and high definition], it is important to make a drop breathe out in the direction designed from the delivery, and to make the drop reach the picture element position where the recording medium was decided, but. By carrying a liquid jet recording head in a recording device body, printing the printed pattern set up beforehand in the conventional method of inspecting these, and conducting operation analysis of this printed pattern by computer, The inspection which checks how many impact positions of the drop have shifted to the decided picture element position is conducted, and factory shipments are carried out after that.

[0007]

[Problem(s) to be Solved by the Invention]By the way, in a liquid jet recording head, a drop breaks through the meniscus produced in the delivery and is breathed out. At this time, a drop is certainly breathed out on that fluid characteristic as a main drop (main drop which forms a picture), and two drops or more of a satellite (drop smaller than the main drop breathed out later than the regurgitation of a main drop). Then, by controlling the impact position of this main drop and a satellite, and changing into the state where the image recognition of the unnecessary impact pixel (satellite) is not carried out, it is the above-mentioned high definition, and a high definition picture is acquired.

[0008]Here, the discharge direction of a drop poses a problem by the ability of a picture [that it is highly minute and high definition] to be acquired, and it is decided by at what kind of angle the delivery is formed to the field where the delivery has been arranged.

That is, the discharging angles of a main drop and a satellite change by change of a delivery angle, when a delivery angle is not proper, it becomes a conspicuous picture of a satellite and a picture [that it is highly minute and high definition] cannot be acquired.

[0009]There were the following problems in the above conventional inspection methods in such a background.

[0010](1) Although it is possible to evaluate the obtained picture simple substance by the conventional inspection method mentioned above, it cannot be checked at what kind of angle the drop has been breathed out from the liquid jet recording head. Therefore, in the conventional inspection method, even when a satellite was observed in a recording medium, since it was impossible to feed back that a delivery formation angle should be changed into the manufacturing process of a liquid jet recording head and it was influenced by that a recording head is made, the yield was not able to be raised.

[0011](2) In the conventional inspection method mentioned above, when inspecting the impact position of a drop, a recording head must be carried in a recording device body, and inspection-system-ized microscope another after an inspection prints the set-up printed pattern -- a printed pattern -- image recognition -- and coordinates record being carried out and, There was a problem of two inspection processes of analyzing by computer how many gaps having arisen to the decided picture element position having been required, and taking time too much by factory shipments.

[0012](3) In the conventional inspection method mentioned above, the non-ecology point of canceling a recording medium having to carry out minimum size limitation for printer feeding, and leaving a useless non-printing area in order that the recording medium used for printing may print with a recorder was also a problem.

[0013]If the recording head which furthermore added, was made to counter or arrange a head unit in parallel, and was produced is attached to the carriage of a recording device body and printed, even if the adjustment for every record element is made of a recording head independent, It was not taken into consideration to the position variation with a device main frame carriage depended for dashing, but there was also a problem that the printing quality at the time of including in a device main frame carriage was spoiled.

[0014]Then, this invention is made in view of the unsolved technical problem which above-mentioned conventional technology has, and the 1st purpose of this invention, Without carrying a liquid jet recording head in a recording device body, in order to acquire a picture [that it is highly minute and high definition], It checks how many impact positions have shifted to the picture element position where the drop breathed out from a liquid jet recording head was decided, The liquid jet recording head impact-area

inspection method which can measure the discharging angles of the main drop which constitutes a drop, and a satellite, and its test equipment are provided. It is providing the manufacturing method of the liquid jet recording head which manufactures the liquid jet recording head which a drop can be made to reach to the picture element position decided with the proper discharging angle.

[0015]In addition to the 1st purpose of the above, the 2nd purpose of this invention is independent. Without carrying a recording head in a recording device body, in order to attain high definition-ization of a recording head, It is providing the recording head test equipment which can measure and inspect the position of the recording pattern recorded on the record element and recording medium of the recording head, and can make the measured data reflect in a recording head manufacturing installation further.

[0016]Other purposes of this invention have the recorder provided with the above-mentioned inspection method, the recording head inspected by test equipment, and this recording head etc. in providing many related inventions.

[0017]

[Means for Solving the Problem]In order to attain the above-mentioned purpose, a liquid jet recording head impact-area inspection method of this invention, Make a discharge energy generation element of a liquid jet recording head drive, make at least one recording ink drop breathe out from a delivery of said liquid jet recording head, and a recording medium estranged and arranged from a discharge opening surface is made to reach the target, Carry out the image recognition of the drop which reached said delivery and said recording medium via said recording medium from a vertical lower part of said discharge opening surface and said recording medium, and each coordinates are recorded, Horizontal distance between both and a vertical distance between a recording medium and a delivery are computed from a part for image recognition coordinate differences from record coordinates of said impact drop and said delivery, and a discharging angle of a drop is computed by this calculation distance being based.

[0018]Liquid jet recording head test equipment of this invention, Recording head holding mechanism holding a liquid jet recording head which has a delivery which carries out the regurgitation of the recording ink by the drive of a discharge energy generation element, A recording-medium fixing means which sets caudad a predetermined interval of a delivery of a liquid jet recording head held at this recording head holding mechanism, and fixes a recording medium, According to an observation system for image processing arranged under said recording medium so that an impact drop which made at least one recording ink drop breathe out from said delivery or this delivery, and reached the target on said recording medium may be observed, and this observation system for image processing. Observe and carry out image processing of the drop which reached said delivery and said recording medium via said recording medium, and those coordinates are recorded, A control means which computes horizontal distance between both and a vertical distance of a recording medium and a delivery from a part for image recognition coordinate differences from record coordinates of an impact drop and a delivery, and computes a discharging angle of a drop by being based in this calculation distance is provided.

[0019]In a liquid jet recording head impact-area inspection method or test equipment of this invention, it can also compute a discharging angle of each drop by a liquid jet recording head having at least two or more rows of outlet ports, and being able to make at

least one recording ink able to breathe out, respectively from each at least two or more rows of outlet ports.

[0020]In a liquid jet recording head impact-area inspection method or test equipment of this invention, a recording medium which it is [recording medium] preferred that total light transmittance is not less than 80% of thing, and a receiving layer containing water soluble resin is applied [recording medium], and makes a drop reach this receiving layer side is preferred for a recording medium.

[0021]And a manufacturing method of a liquid jet recording head of this invention, Data about a discharging angle of a drop which reached a delivery by which image recognition was carried out with an above-mentioned liquid jet recording head impact-area inspection method, and a recording medium, and a computed drop is made to feed back to a manufacturing process of a liquid jet recording head, It made as [process / with a proper discharging angle / a delivery].

[0022]Recording head test equipment of other gestalten of this invention, A recording head fixing machine style which makes a reference position of a recording head which has two or more record elements which form a dot pattern contact a specific position of test equipment, and fixes said recording head, Recording-medium standing ways which set a predetermined interval to a record element of said recording head fixed to this recording head fixing machine style, and fix a recording medium, An observation system for image processing which observes a recording pattern etc. which are recorded on a record element and said recording medium of said recording head, A recording control means which controls said recording head to record a recording pattern on said recording medium, It has an inspection means which inspects printing impact performance of said recording head from a reference position of said recording head by carrying out image processing of the record element of a recording pattern recorded on said recording medium, or said recording head, Said recording head fixing machine style makes a recording head contact with the same gestalt as a contact mechanism of a recording device body, and is fixed.

[0023]In liquid jet recording head test equipment of this invention, it is preferred to have a data writing means for making a memory measure in which information about a computed discharging angle and information about inspected drop impact performance were provided by liquid jet recording head memorize.

[0024]It has a memory measure for a liquid jet recording head of this invention being a liquid jet recording head by which a discharging angle of a drop, etc. are inspected by an above-mentioned liquid jet recording head impact-area inspection method, and memorizing information about a discharging angle computed by this inspection method.

[0025]A liquid jet recorder of this invention is a liquid jet recorder which can carry an above-mentioned liquid jet recording head, and is provided with a reading means which reads information about a discharging angle memorized by said memory measure.

[0026]

[Function]According to the liquid jet recording head impact-area inspection method and liquid jet recording head test equipment of this invention, how many impact positions having shifted to the picture element position where the drop breathed out from a liquid jet recording head was decided, or it being checked whether the position of a delivery is still more proper, and, without carrying a liquid jet recording head in a recording device body, The discharging angles of the main drop which constitutes a drop, and a satellite

can be measured. In the case where the impact position has shifted to the picture element position decided by this when a satellite was observed in a recording medium etc., it becomes possible to feed back a delivery formation angle to the manufacturing process of a liquid jet recording head promptly that an adjustment change should be made.

Therefore, the data measured and computed can be made to be able to reflect in the manufacturing process of a liquid jet recording head promptly, it can become possible to manufacture a proper and high-definition liquid jet recording head, and the yield of a product can be raised greatly.

[0027]A recording head can be inspected without printing with a recording device body, what is necessary is just to use the recording medium which is the degree of necessary minimum, and it becomes an inspection system [ecology / inspection system / present]. [0028]According to the recording head test equipment of other gestalten of this invention, image processing of the record dot recorded by printing control where a recording head is fixed by the same recording head fixing machine style as a recording device body can be carried out, Since it can inspect to the relative recorded state in the same state as the time of the attachment to the device main frame carriage of a recording head, in a head simple substance, it becomes possible the amount of relative gaps on an unclear recording device body, and to measure the amount of gaps absolutely.

[0029]In other recording heads, such measurement data can be measured as printing impact performance as drop impact performance in a liquid jet recording head, and it is high resolution and it makes it possible to data-ize printing quality of a high definition recorder directly.

[0030]The amount of impact gaps of a recording head element can be measured from the physical relationship of the record element corresponding to the record dot and it which were measured, raising the yield, since the data about this amount of gaps is utilizable as data made to reflect in a head manufacturing installation (the case of a liquid jet recording head delivery manufacturing installation) suitably -- high resolution -- and a high definition recording head is establishable by a manufacturing stage.

[0031]By making the recording head record or memorize the data about discharging angle information, an impact-area position gap, etc. which were measured by a recording head inspection method and test equipment, and were computed according to the recording head and recorder of this invention, This data is read in a recording head at the time of wearing to the recorder of a recording head, and printing execution, etc., It can become possible to perform amendment and adjustment of discharging timing etc. at the time of printing execution, and to perform printing which does not have an impact-area position gap at the optimal discharging timing for each recording head, and record, and the yield of a recording head can be raised greatly.

[0032]

[Embodiment of the Invention]An embodiment of the invention is described based on a drawing.

[0033](The 1st example) Drawing 1 is a lineblock diagram which illustrates roughly the liquid jet recording head test equipment of the 1st example of this invention.

[0034]In drawing 1, 1 is the liquid jet recording head (only henceforth a recording head) 1a which carries out the regurgitation of the recording ink, such as ink, with an electrical signal, and a recording head cartridge (ink jet cartridge) which comprises the recording ink tank 1b which stores recording ink.

The base carriage 2 which is fixed by the positioning member 2a, 2b, and 2c, and holds this recording head cartridge 1 is supported by the stage device carried on the base 12. This stage device equips the movable Y stage 7, X stage 6 movable in the direction of X, and a Z direction with movable Z stage 5 in accordance with the direction of Y on the base 12. It has the GONIO stages 3a and 3b which can adjust the degree of setting angle of the theta stage 4 and the base carriage 2 which can adjust a horizontal angle on Z stage 5. Therefore, the base carriage 2 can be attached by the GONIO stages 3a and 3b, and an angle can be adjusted. Horizontal angle adjustment is constituted so that the theta stage 4 can perform, and in order to adjust the distance of the delivery and the recording medium 11 arranged caudad of the recording head 1a, Z stage 5 is used. And when performing measurement for a recording head impact-area inspection, in order to move the recording head cartridge 1 in the direction of X, and the direction of Y, X stage 6 and the Y stage 7 are used. Since these stages have the great influence which the moving accuracy has on a measurement-coordinates value, an automatic stage needs to use the stage of the ball screw according to accuracy preferably.

[0035]Fixed holding of the recording medium 11 which the drop which carries out the regurgitation from the delivery of the recording head 1a is made to reach is carried out by exhaust air adsorption etc. on the recording-medium adsorption base 10 carried in the base 12 so that the recording head 1a of the recording head cartridge 1 held on the base carriage 2 might be countered and it might be located. In order that the recording medium 11 may read an impact area of recording ink correctly, the receiving layer which contains the good water soluble resin of liquid absorptivity so that it may not become the shape in which the drop immediately after reaching a recording medium spreads at random is applied.

The recording medium 11 has a desirable thing which has high total light transmittance and whose thickness is thin, and the thing of not less than 80% of total light transmittance is preferred for it especially at 200 micrometers or less in thickness so that an impact drop, the delivery of the recording head 1a, etc. can be observed from the lower part of a recording medium.

And restrictions of the recording form conveyance mechanical-shaft-seal stems (conveyance roll pitch etc.) in a recording device body do not have a size of the recording medium 11, it should just be a size which can stick to the recording-medium adsorption base 10, and can also be considered as the necessary minimum amount of media usage by using a rolled state. Although the fixing method of the recording medium 11 can be replaced with exhaust air adsorption and an electric adsorption method can also be used, when using an electric adsorption method, it must be considered that the drop breathed out does not receive electrical influence.

[0036]And the camera 9 for image processing for observing and carrying out the image recognition of the drop which reached the delivery and the recording medium 11 of the recording head 1a (for example, CCD) is arranged under the recording medium 11, and it is constituted so that Z stage 8 can perform focusing. Therefore, as mentioned above, the recording medium 11 is a place where the thing with thin thickness which has high total light transmittance is desirable, so that it may let the recording medium 11 pass and image processing of a delivery or the impact drop can be observed and carried out with the camera (CCD) 9 for image processing.

[0037]Although fixed to the base 12, it is more preferred for the above device

components to attach via vibration absorption rubber (not shown) for the precision improvement of a measurement-coordinates value.

[0038]Although the recording head test equipment of this example is not illustrated to drawing 1, The recording head drive control means which carries out drive controlling of the liquid discharging of the recording head 1a, etc., The stage control means which controls adjustment and a drive of each stage, and the image-processing-control means for monitoring a delivery, an impact drop, etc. which are observed with the camera (CCD) 9 for image processing, and carrying out image processing of them, And each of these control means are controlled and CPU provided with the function which feeds back various kinds of data which it was further measured and was calculated to a recording head manufacturing process is provided.

[0039]Drawing 2 illustrates an example of the liquid jet recording head which can be applied to the recording head test equipment of the 1st example of this invention, and the (a) is a side view of a recording head cartridge.

The (b) is the rough top view seen from the side by which the recording head was provided in the delivery, and the (c) is a decomposition explanatory view of the component parts of a recording head.

[0040]the heater board 19 (19a.) which allocated two or more liquid flow channel members forming 22 in which two or more detailed deliveries 15 and 16 and liquid flow channels (not shown to drawing 2) to which the recording head 1a carries out the regurgitation of the drop were provided, and heater elements which carry out thermal conversion of the electrical signal the flexible cable 17 (17a.) which allocated 19b and two or more contact pads 18 (18a, 18b) It has 17b, the heat sink 20 (20a, 20b), and the presser-foot spring 21 (21a, 21b), it is combined with the recording ink tank 1b, and the recording head cartridge (ink jet cartridge) 1 is constituted. Although the liquid flow channel members forming 22 is made by plastic molding or metal mechanism processing, the channel and the deliveries 15 and 16 of recording ink are formed by laser processing, mechanism processing, etc. the heater board 19 (19a.) which allocated the heater element which carries out thermal conversion of the electrical signal connected with the flexible cable 17 (17a, 17b) and the lead 23 (refer to (a) of drawing 3) 19b is stuck to the heat sink 20 (20a, 20b) via thermally conductive good adhesives (un-illustrating) for the improvement in a radiation effect. Adhesion junction is carried out with the liquid flow channel members forming 22 with the presser-foot spring 21 (21a, 21b), and a liquid flow channel completes this heat sink 20 and the stuck heater board 19 inside. Two or more contact pads 18 (18a, 18b) allocated by the flexible cable 17 (17a, 17b) are pads for performing an exchange of a recording device body and an electrical signal, when a recording device body is equipped with the recording head cartridge 1.

[0041](a) of drawing 3 is a fragmentary sectional view fractured and shown along the A-A line of the recording head in (b) of drawing 2, and the (b) is an expanded sectional view of a delivery portion.

[0042]In drawing 3, the heater board 19 and the flexible cable 17 are tied by the lead 23, In order to have completed the passage groove 26 and the fluid chamber 24 by sticking the heater board 19 and the liquid flow channel members forming 22 with the presser-foot spring 21 and to raise the sealing nature in this adhesion condition, the encapsulant (un-illustrating) excellent in ink-proof nature and gas barrier property-proof is used.

[0043]And in the delivery 16 as shown in (b) of drawing 3, and the liquid flow channel constituted by the passage groove 26, the discharge direction of the drop breathed out from the delivery 16 is determined by the perforation angle of the delivery 16 to the liquid regurgitation side 25.

[0044]Here, the discharging state of the drop in the recording head with a proper perforation angle to a liquid regurgitation side and the recording head which is not proper of a delivery is explained using drawing 4 thru/or drawing 6.

[0045]First, the case where breathed out recording ink in the recording head cartridge which comprised a liquid jet recording head in which the delivery was formed at the proper delivery angle, and it is made to reach the target to a recording form is explained with reference to drawing 4.

[0046]Drawing 4 illustrates the state where the delivery breathed out the drop using the liquid jet recording head formed with the proper perforation angle to the liquid regurgitation side.

The (a) is an expanded sectional view of the liquid flow channel of a recording head, the (b) is an impact constitutional diagram showing the impact state of a main drop and a satellite which constitutes the drop which reached the recording form, and the (c) is a constitutional diagram immediately after breathing out a drop from a recording head to a recording form.

[0047]The delivery 16 of the liquid flow channel in the recording head 1a illustrated to drawing 4 is formed with proper delivery angle θ_{d1} to the line vertical to the liquid regurgitation side 25, as shown in (a) of drawing 4.

The drop which reached the recording form 27 by this recording head 1a will be in the state which shows in (b) of drawing 4.

28 is a main drop which constitutes a drop, 29 is a satellite which constitutes a drop, and since the satellite 29 has reached the target inside the main drop 28, when seeing as a picture, the satellite 29 is hardly conspicuous. That is, the picture which makes only a required impact pixel recognize is acquired. An arrow shows the feed direction of a recording head, i.e., a scanning direction, and the feed direction of a recording form, i.e., a vertical scanning direction, among (b) of drawing 4, respectively.

[0048]Thus, when a delivery angle is proper angle θ_{d1} , as shown in (c) of drawing 4, the main drop 28 and the satellite 29 are breathed out equally to the θ_{d1} direction from the delivery 16, and can acquire the picture in which the satellite 29 which is illustrated to (b) of drawing 4 as a result is not conspicuous.

[0049]Next, from a proper delivery angle, the case where breathed out recording ink in the recording head cartridge which comprised a recording head in which the delivery was formed at the angle shifted, and it is made to reach the target to a recording form is explained with reference to drawing 5.

[0050]Drawing 5 illustrates the state where the perforation angle to the liquid regurgitation side of a delivery breathed out the drop using the recording head which is not proper.

The (a) is an expanded sectional view of the liquid flow channel of a recording head, the (b) is an impact constitutional diagram showing the impact state of a main drop and a satellite which constitutes the drop which reached the recording form, and the (c) is a constitutional diagram immediately after breathing out a drop from a recording head to a

recording form.

[0051]The delivery 16 in the recording head 1a illustrated to drawing 5 is formed with perforation angle θ_2 which is not proper to the liquid regurgitation side 25, as shown in (a) of drawing 5.

The drop which reached the recording form 27 by this recording head 1a will be in the state which shows in (b) of drawing 5.

28 is the main drop which reached the recording form 27, 29 is a satellite, and since the satellite 29 has reached the outside of the main drop 28, it is in the state of having been conspicuous. That is, it is a picture which makes an unnecessary impact pixel recognize.

[0052]This is formed at an angle called θ_2 to the liquid regurgitation side 25 in the delivery 16.

Since it is different delivery angle θ_2 from proper delivery angle θ_1 in the recording head mentioned above, It will be breathed out by angle θ_2 which differs in the main drop 28 and the satellite 29 from the delivery 16, respectively, and θ_3 , and the satellite 29 will be a conspicuous impact picture so that it may illustrate to (c) of drawing 5.

[0053]The case where breathed out recording ink in the recording head cartridge which comprised a recording head by which the delivery was formed in delivery angle θ_2 and the opposite direction which were mentioned above, and which are not proper with the angle which is not proper, and it is made to reach the target to a recording form is explained with reference to drawing 6.

[0054]Drawing 6 illustrates the state where the perforation angle to the liquid regurgitation side of a delivery breathed out the drop using the recording head which is not proper.

The (a) is an expanded sectional view of the liquid flow channel of a recording head, the (b) is an impact constitutional diagram showing the impact state of a main drop and a satellite which constitutes the drop which reached the recording form, and the (c) is a constitutional diagram immediately after breathing out a drop from a recording head to a recording form.

[0055]The delivery 16 in the recording head 1a illustrated to drawing 6 is formed with perforation angle θ_4 which is not proper to the liquid regurgitation side 25 so that it may illustrate to (a) of drawing 6.

The drop which reached the recording form 27 by this recording head 1a will be in the state which shows in (b) of drawing 6.

That is, since the satellite 29 has reached the outside of the main drop 28, the satellite 29 is in the state of having been conspicuous, and has become a picture to which the image recognition of the unnecessary impact pixel is carried out.

[0056]This is formed at an angle called θ_4 to the liquid regurgitation side 25, as the delivery 16 shows (a) of drawing 6.

Since it is different delivery angle θ_4 from proper delivery angle θ_1 in the recording head mentioned above, It will be breathed out by angle θ_4 which differs in the main drop 28 and the satellite 29 from the delivery 16, respectively, and θ_5 , and the satellite 29 has become a conspicuous impact picture as a result so that it may

illustrate to (b) of drawing 6, so that it may illustrate to (c) of drawing 6. Since this recording head is formed in delivery angle θ_2 and the opposite direction which were mentioned above and which are not proper, When the liquid regurgitation of the recording head is sent and carried out to a scanning direction contrary to the scanning direction of (b) of drawing 5 (head feed direction) so that it may illustrate to (b) of drawing 6, the satellite 29 serves as a conspicuous impact picture so that it may illustrate to (b) of drawing 6.

[0057]As mentioned above, when the delivery angle of a liquid jet recording head is formed at the angle which is not proper, the discharging angles of the main drop which constitutes a discharged liquid drop, and a satellite will differ, and it will be an impact picture which is a satellite and in which it is conspicuous, i.e., an unnecessary impact pixel is conspicuous by the scanning direction of a recording head cartridge.

[0058]Next, the mode which computes the discharging angle of a recording head and feeds back this computed result to the manufacturing process (especially delivery forming process) of a liquid jet recording head is explained using the liquid jet recording head test equipment in this example.

[0059]Drawing 7 is a flow chart which shows the measurement flow which computes a discharging angle using the liquid jet recording head test equipment in the 1st example of this invention.

Hereafter, it explains in accordance with the flow of drawing 7.

In this measurement flow, measurement of the coordinates of the delivery for measuring the normal coordinate of a liquid jet recording head and an impact area, an impact area, etc. is observed with the camera (CCD) 9 for image processing arranged under the recording medium 11, and is performed by carrying out image processing so that it may illustrate to drawing 1. (a) of drawing 8 will show the state where the image recognition of the recording head 1a which constitutes the recording head cartridge 1 illustrated to drawing 1 was carried out with the camera (CCD) 9 for image processing from the altitude lower part, and this picture will be recognized via the recording medium 11. Therefore, the recording medium 11 has a desirable thing which has high total light transmittance and whose thickness is thin, and as mentioned above, the thing of not less than 80% of total light transmittance is preferred for it at 200 micrometers or less in thickness especially.

[0060]First, attachment (S1) of a liquid jet recording head (recording head cartridge) fixes the recording head 1a to the base carriage 2 of liquid jet recording head test equipment by the positioning member 2a, 2b, and 2c so that it may illustrate to drawing 1. In order to carry out device reappearance of the discharging state in a recording device body at this time, the same positioning as the carriage of a recording device body is desirable. And attachment (S2) of a recording medium fixes the recording medium 11 by exhaust air adsorption etc. on the recording-medium adsorption base 10.

[0061]In S3 and S4, the normal coordinate of the recording head 1a is measured. Here, as a normal coordinate of the recording head 1a, when processing the recording head 1a, the working standard part made into the standard or the attachment reference position to a recording device body can be used. The standard part of the recording head 1a is moved to a normal coordinate measuring point by X stage 6 or Y stage 7 grade, the reference position of the recording head 1a is observed with the camera (CCD) 9 for image processing, and a normal coordinate is measured and recorded by carrying out image

processing.

[0062]And in S5, the delivery (henceforth an impact-area measurement delivery) for measuring an impact area is moved to the measuring point of the camera (CCD) 9 for image processing by X stage 6 or Y stage 7 grade. The E section in (a) of drawing 8 is an impact-area measurement delivery, and (b) of drawing 8 shows the state where the impact-area measurement delivery was observed, and is in the state where the measurement cursor F was doubled with the center of the impact-area measurement delivery 16 which is a measuring object. At this time, movement of Z stage 8 can perform focusing of the camera (CCD) 9 for image processing. Then, the coordinates of an impact-area measurement delivery are measured and recorded (S6).

[0063]In S7, the regurgitation of the recording ink is carried out that a recording medium should be reached in a drop from an impact-area measurement delivery. Since the regurgitation of recording ink tends to be influenced by the viscous rise by the dryness of a delivery, i.e., evaporation of recording ink, color adherence, the minute garbage which adheres to a delivery further, etc., it needs to perform the following preliminary discharge sequences, for example.

1. Preliminary discharge Drive frequency: 2kHzx500 shot 2. measurement regurgitation It is necessary to perform the preliminary discharge and the measurement regurgitation of these of one shot within [the effect of preliminary discharge is not lost] for several seconds. After such a preliminary discharge sequence, the state where the recording ink breathed out from the impact-area measurement delivery reached the target on the recording medium 11 is illustrated at (c) of drawing 8. The main drop 28 and the satellite 29 are observed in (c) of drawing 8.

[0064]Next, in S8, carry out moving regulation of the camera (CCD) 9 for image processing using Z stage 8, and perform focusing to the impact drops 28 and 29 on the recording medium 11, and it ranks second to them, Each coordinates are measured and recorded by doubling the measurement cursor G and H one by one, and carrying out image processing to each center of the main drop 28 which constitutes a drop, and the satellite 29 so that it may illustrate to (c) of drawing 8.

[0065]And in S10 and S11, data processing is performed based on each coordinate value which measured as mentioned above and was recorded, and the discharging angle of a main drop and a satellite is computed. that is, the distance (Z direction) between a delivery and a recording medium from the image recognition Z coordinate difference of the record coordinates of an impact-area measurement delivery, and a recording-medium impact drop, [compute and (S10)] The horizontal distance between a delivery and a recording-medium impact drop is computed from the image recognition horizontal-coordinates difference of the record coordinates of an impact-area measurement delivery, and a recording-medium impact drop, and a liquid discharging angle is computed from these deliveries, the distance (Z direction) between recording-medium impact drops, and horizontal distance (S11).

[0066]As mentioned above, by using the liquid jet recording head test equipment of this example, an impact drop picture which is illustrated to (b) of drawing 4, (b) of drawing 5, and (b) of drawing 6 being acquired, without using a recording device body and a recording form, and, How many impact positions have shifted to the picture element position where the drop breathed out from a recording head was decided, or it can be checked whether the position of a delivery is still more proper, and each discharging

angle of the main drop which constitutes an impact drop, and a satellite can be computed further. As a result, if a difference is observed in each discharging angle of a main drop and a satellite, Judge that it is not a discharging angle of proper liquid, and it is measured and the computed data The manufacturing process of a liquid jet recording head, Especially, it can pass and feed back, the data which it became possible a delivery forming process and to adjust a delivery machining angle suitably, and was measured and computed can be made to reflect in a manufacturing process promptly, and it becomes possible to manufacture a proper and high-definition liquid jet recording head. [0067]It is also possible to check the impact drop queue length illustrated to (b) of drawing 4, (b) of drawing 5, and (b) of drawing 6 by carrying out data processing of the measurement coordinates if needed.

[0068]Next, the case where the ink (I and J) which is two kinds of recording ink is carried in the liquid jet recording head which constitutes a recording head cartridge is explained.

[0069](a) of drawing 9 is the top view which looked at the recording head cartridge which comprised a liquid jet recording head which has the delivery 30 (ink: I) where a perforation angle is proper, and the delivery 31 (ink: J) whose perforation angle is not proper from the liquid regurgitation side side, (b) of drawing 9 is an expanded sectional view of the liquid flow channel of the recording head 1a, and the delivery 30 is formed by proper delivery angle θ_6 to the liquid regurgitation side 25, The delivery 31 which the delivery 31 is formed to the liquid regurgitation side 25 by delivery angle θ_7 which is not proper, namely, carries out the regurgitation of the ink J illustrates the state of being different delivery angle θ_7 from proper delivery angle θ_6 . And (a) of drawing 10 is a drawing in which the impact state of the main drops 32 and 34 of a drop and the satellites 33 and 35 which reached the recording form 27 of the ink breathed out, respectively from the deliveries 30 and 31 of the liquid jet recording head illustrated to drawing 9 is shown, (b) of drawing 10 is a constitutional diagram immediately after breathing out the ink I and J from the recording head 1a to the recording form 27.

[0070]In (a) of drawing 10, since the ink I breathed out by the recording form 27 is breathed out from the delivery 30 formed by proper delivery angle θ_6 , the satellite 33 has reached the target inside the main drop 32. Therefore, it is a picture to which the image recognition only of the required impact pixel in which a satellite is not conspicuous is carried out. since [however,], as for the ink J breathed out from the delivery 31 formed by delivery angle θ_7 which is not proper, the satellite 35 has reached the outside of the main drop 34 -- a satellite -- being conspicuous -- that is, it is a picture which carries out image recognition about the unnecessary impact pixel.

[0071]In the θ_6 direction, (b) of drawing 10 is a constitutional diagram immediately after breathing out the ink I and J from the recording head 1a to the recording form 27, and the main drop 32 and the satellite 33 of the ink I are equally breathed out from the delivery 30, and as a result, It becomes an impact picture in which a satellite is not conspicuous so that it may illustrate to (a) of drawing 10. On the other hand, the main drop 34 and the satellite 35 of the ink J are breathed out in θ_7 and the θ_8 direction from the delivery 31, respectively, and as a result, they have become a conspicuous impact picture of a satellite so that it may illustrate to (a) of drawing 10. Here, both the deliveries 30 and the distance L between 31 become an important factor of how much to shift to the decided picture element position. That is, it is because the impact gap K of the ink I and the ink J illustrated to (a) of drawing 10 will become large proportionally if the

distance L between both deliveries is large.

[0072]As mentioned above, the delivery 31 which carries out the regurgitation of the ink J is formed by different delivery angle θ_7 from proper delivery angle θ_6 .

The main drop 34 and the satellite 35 will be breathed out at an angle different, respectively, and the ink J will be a conspicuous impact picture of a satellite so that it may illustrate to (a) of drawing 10, and (b).

[0073]The ink breathed out, respectively can be variously chosen from the deliveries 30 and 31 in this example according to those uses. For example, in order to acquire a picture [that it is highly minute and high definition], each dye concentration of ink is changed. Or in order to raise the water resisting property of ink, the treating solution of the following presentations is carried in either of the ink I or J as record processing liquid.

<Record processing liquid presentation> glycerin Seven-copy diethylene glycol Seven-copy polyallylamine Four-copy benzalkonium chloride One-copy water Remainder (in addition, acetic acid adjusts the above-mentioned treating solution to pH=7.5.)

[0074]Since the water resisting property of ink will fall remarkably if the half or more dots impact gap K of the ink I and J ((a) of drawing 10) shifts when it carries this record processing liquid. Not only in the discharging angle difference of a main drop and a satellite, it becomes an important inspection item how much it will shift to the decided picture element position.

[0075]In order to obtain the liquid regurgitation stable in S7 (drawing 7) of the measurement flow mentioned above, the preliminary discharge sequence is performed, but in order for the above-mentioned record processing liquid to tend to receive the influence of desiccation, garbage, etc. from usual ink, it is necessary to perform the following preliminary discharge sequences, for example.

1. preliminary discharge drive frequency: -- 2 kHz x 1000 shots 2. measurement regurgitation It is necessary to perform the preliminary discharge and the measurement regurgitation of these within [the effect of preliminary discharge is not lost] for several seconds and, and they need to change the preliminary discharge sequence of one shot suitably according to change of the presentation of ink or record processing liquid.

[0076]It is water-white, and since the above-mentioned record processing liquid has bad visibility, it is more preferred for it by applying the coating liquid of the following presentation to a recording medium to make it make an impact area color.

<Recording-medium coating liquid composition> poly vinyl alcohol (PVA-205 Kuraray Co., Ltd. make)

Copies [15] Bromothymol Blue 0.4 Copy Water Remainder[0077]It applies and the coating liquid of such a presentation is dried so that it may become 10 micrometers of dry membrane thickness on a 100-micrometer-thick polyethylene terephthalate film, and a receiving layer is formed.

[0078]Next, the mode which computes the discharging angle of each delivery in the recording head cartridge in which two kinds of recording ink was carried using the liquid jet recording head test equipment of the 1st example of this invention, and is fed back to the manufacturing process of a liquid jet recording head is explained.

[0079]Drawing 11 is a flow chart which shows the measurement flow which computes the discharging angle of each delivery of a recording head, respectively using the liquid jet recording head test equipment illustrated to drawing 1.

Hereafter, it explains in accordance with the flow of drawing 11.

[0080]In S21-S24, like S1 explained in relation to the measurement flow of drawing 7 - S4, a liquid jet recording head and a recording medium are attached to liquid jet recording head test equipment, respectively, and the reference position of a liquid jet recording head is measured and recorded.

[0081]Subsequently, in S25-S29, those coordinates are measured and recorded like S5 explained in relation to the measurement flow of drawing 7 about the impact drops 32 and 33 (refer to drawing 10) breathed out from the impact-area measurement delivery 30 and the delivery 30 for measuring an impact area - S9. And in S30-S34, those coordinates are measured and recorded like S5 explained in relation to the measurement flow of drawing 7 also about the impact drops 34 and 35 (refer to drawing 10) breathed out from the impact-area measurement delivery 31 and the delivery 31 - S9. Then, in S35 and S36, like S10-S11 which were explained in relation to the measurement flow of drawing 7, Based on the record coordinates of each impact-area measurement delivery 30 and 31 and the impact drops 32, 33, 34, and 35, the distance (Z direction) between a delivery and a recording medium and the horizontal distance between a delivery and an impact drop are computed, and each liquid discharging angle of the deliveries 30 and 31 is computed.

[0082]As mentioned above, by using the liquid jet recording head test equipment in the 1st example of this invention, the picture of the impact ink I and J which is illustrated to (a) of drawing 10 being acquired, without using a recording device body and a recording form, and, How many impact positions have shifted from each delivery to the picture element position where each drop breathed out was decided, or it can be checked whether the position of each delivery is still more proper, and each main drop of the impact ink I and J and the discharging angle of a satellite can be computed further. If a difference is observed in the discharging angle of a main drop and a satellite, it will be judged that it is not a proper liquid discharging angle. It is measured and the computed data The manufacturing process, especially delivery forming process of a liquid jet recording head, It passes, and it can feed back, the data which it became possible to adjust a delivery machining angle suitably, and was measured and computed can be made to reflect in a manufacturing process promptly, and it becomes possible to have a proper liquid discharging angle and to manufacture a high-definition liquid jet recording head.

[0083]It is also possible to check the impact ink queue length illustrated to (a) of drawing 10 by carrying out data processing of the measurement coordinates if needed.

[0084]And the distance L between the deliveries 30 and 31 leading to an impact position gap important for the case where the record processing liquid mentioned above is carried, or a picture [that it is highly minute and high definition] can be easily checked by carrying out data processing of the part for the record coordinate differences of S26 and S31 in the measurement flow shown in drawing 11.

[0085]Drawing 12 is a flow chart which shows the flow which feeds back properly the delivery formation angle explained above and a formation position. In drawing 12, a process [A] is a manufacturing process of a liquid jet recording head, and a process [B], The mode which feeds back those data to a delivery work process if needed according to the inspection process by liquid jet recording head ***** of this invention, a position gap of an impact area, a position gap of a discharging angle and a delivery which were measured or computed, etc. is illustrated. By this, without using a recording device body

and a recording form A position gap of the impact drop of a recording head, and a position gap of a delivery, Furthermore a liquid discharging angle can be measured, and moreover, those data can be promptly fed back to the manufacturing process of a recording head, and can be made to be able to reflect in it, it can become possible to have a proper liquid discharging angle and to manufacture a high-definition recording head, and the yield of a product can be raised greatly.

[0086](The 2nd example) Drawing 13 is a perspective view which illustrates roughly the main composition of the recording head test equipment of the 2nd example of this invention.

Drawing 14 is a configuration block figure of the control system of the recording head test equipment of the 2nd example of this invention.

[0087]Recorders, such as a liquid jet recorder, are constituted so that reciprocation moving of the record head carriage which carries a recording head may generally be carried out in the direction which intersects perpendicularly with a paper feed direction and image formation may be performed.

The printing impact performance of a recording head is measurable by physical relationship with the impact position which keeps a predetermined distance between the position of a record element, and the record element and recording form in a state of rest, and is recorded on it.

Therefore, in order to reproduce the image recording state in a recording device body as test equipment of a recording head, it is important to satisfy the interval distance of a record element and a recording form like a device main frame, and to provide the same recording head fixing machine style as the carriage of a device main frame.

[0088]In drawing 13, the recording head fixing machine style for fixing the recording head 41, It has the recording head fixture 42 carried in the moving stage (un-illustrating) movable in X and the direction of Y, The contact member 43 of L type which contacts the opening 42a and the reference part of the recording head 41 which accept the recording head 41, and which were penetrated is allocated by this recording head fixture 42, The X-axis thrust reliance cylinder 44 and the Y-axis thrust reliance cylinder 45 are formed in the part which counters each straight part of the contact member 43 of L type. And it is desirable to form the mechanism (un-illustrating) which regulates a recording head to a path-of-insertion specific position like a device main frame. While facing equipping the recording head fixture 42 with the recording head 41, inserting the recording head 41 in the opening 42a and making the reference part of the recording head 41 contact the contact member 43 of L type, The X-axis and a Y-axis dash, operate the cylinders 44 and 45, the contact member 43 is made to contact more certainly, and the recording head 41 is fixed. Thus, the wearing gestalt of a recording head is reproducible in recording head test equipment by making a recording head fixing machine style into the same mechanism as the head holding part of the carriage of a device main frame, and the same mode.

[0089]The recording medium 47 is fixed by adsorption etc. on the recording-medium standing ways 46 carried in the moving stage which is not illustrated. This recording medium 47 is positioned under the recording head 41 fixed to the recording head fixture 42, and the interval with the record element of this recording head 41 is set up become a record element in a device main frame, and the default value of the interval of a recording

form. And the gestalt of a continuation sheet may be sufficient so that it may illustrate as the recording medium 47, but a thing excellent in the light transmittance state like an OHP sheet is desirable.

[0090]The camera 48 for image processing for observing and carrying out image processing of the record pixel (or drop) which reached the target on the record element of the recording head 41 fixed to the recording head fixture 42 or the recording medium 47 is arranged down the recording-medium standing ways 46, and is carried in a movable stage (un-illustrating) at a Z direction. It becomes possible to observe the record element of the recording head 41 through the recording medium 47, without evacuating the recording medium 47 and the recording-medium standing ways 46 at every observation, if the recording medium 47 is light transmittance state material when observing the record element of the recording head 41 with the camera 48 for image processing and carrying out image processing.

[0091]It becomes a necessary condition of this test equipment that the fixing machine style which fixed the recording head 41, and the recording-medium standing ways 46 are positioned with high precision. And as for this test equipment, when a device's own accuracy cannot attain default value, it is desirable to have a function which can amend the accuracy. When measuring a recording head, it is important to pass the sequence which certainly checks the accuracy of test equipment.

[0092]Each mechanism explained by drawing 13 is controlled via each control means from CPU60 which becomes a host to illustrate to drawing 14. The recording control means 61 creates a driving signal required for the printing operation of the recording head 41, and also performs control of the voltage simultaneously impressed to the recording head 41. The cylinder stage control means 62 controls the cylinder for immobilization of a recording head, and contains drivers, such as a pulse motor which moves each moving stage further in the case of printing record or image processing. A moving stage moves simultaneously the recording head fixture 42 and the recording-medium standing ways 46 in the direction of X, and the direction of Y, and makes the camera 48 for image processing movable only at a Z direction. It is important for these moving stages to suppress pitching and yawing of each stage as much as possible. The image-processing-control means 63 observes the record dot etc. which reached the positioning reference part of the recording head 41, the record element, and the recording medium via the camera 48 for image processing, and performs those image arithmetic processings, and also it measures the check point of device accuracy. Link a device accuracy verifying means (un-illustrating) with said cylinder stage control means 62, and it is attained, and also the feedback means using a laser length measuring machine etc. may be sufficient as it. CPU60 is provided with a means to communicate so that the measurement data measured with this test equipment can be fed back to a recording head manufacturing process.

[0093]Next, the inspection routine using the recording head test equipment of the 2nd example of this invention is explained along with drawing 15 which is an operation flow chart.

[0094]Recording head test equipment starts the starting processing for making it the waiting state of operation which contains starting point **** simultaneously with power supply starting in S41 and S42. Here, if test equipment has abnormalities, when starting point **** is performed again and there is a problem, it shifts to abnormal termination

processing. In being normal, wearing of a recording head is urged to test equipment (S43), and it shifts to the sequence which checks device accuracy after recording head wearing (S44). This function is an important function which makes reliability of measurement data a positive thing.

This device accuracy check sequence has a state of the recording head fixed to the recording head and the contact member in judging whether exact measurement can be attained.

The judgment item is (1). Positive attachment of the recording head is attained or it is (2). In the initial position of test equipment, it is [whether a factor which needs offset has occurred, and] **.

[0095](1) If ***** is a full thrust reliance method, although the possibility of generating is low, we will be anxious about the gap by a foreign matter etc. In this case, since image processing cannot be carried out in a normal position, it is retried. (2) As for a factor, the erroneous insertion of a recording head and the poor precision of test equipment are raised. When a recording head dashes to a contact member in the state of erroneous insertion and is carried out, the parallelism of the surface (in a liquid jet recording head, it is a delivery plate) of a recording head stops coming out, and the accuracy of measurement (in a liquid jet recording head, they are the accuracy of measurement, such as a discharging angle) will be dropped. Also when similarly it is in the state where test equipment itself cannot obtain accuracy, the accuracy of measurement falls. This test equipment is (1) in order to make these accuracy of measurement into a positive thing. The attachment parallelism of a recording head is established by carrying out at least three-point image processing of the surface (for example, setting to liquid jet recording head delivery plate) top of a recording head.

(2) Establish test equipment accuracy by carrying out at least three-point image processing of the back side of a recording head fixture.

(3) Above (1) Or (2) In the case which is not suitable, the address feedback corresponding to high precision measurement is needed for three-dimensional coordinates by carrying out offset processing.

[0096]And after the device accuracy check of S44 is completed, it shifts to the sequence which performs reference position setting out (S45). Setting out of this reference position is performed so that it may explain below with reference to drawing 16. Various kinds of data later mentioned by the metrics set up here is measured.

[0097]In order to explain setting out of a reference position, (a) of drawing 16 is a schematic diagram illustrating near [in a recording head fixture] a contact part, and illustrates the state where the reference part of a recording head is in contact with the contact member 43 of L shape. In (a) of drawing 16, 50 is a delivery plate of the liquid jet recording head as an example of a recording head.

It is a thing of form in which the two rows of outlet ports 51 and 52 were formed on the delivery plate 50.

The contact member 43 can be variously changed according to the gestalt of a recording head, and is not limited to the shape of a graphic display. (b) of drawing 16 expands and illustrates near a contact part, and although it is good not to be the delivery plate 50 of a recording head as for the part made to contact the contact member 43, in the figure, the state where at least four reference parts of the delivery plate 50 of a recording head are in contact with the contact member 43 is shown. By observing these at least four points with

the camera 48 ([drawing 13](#)) for image processing, and carrying out image processing, two points, a and b, prescribe the X-axis, and two points, c and d, prescribe a Y-axis, and let the intersection of this X-axis and a Y-axis be the starting point O of measurement (X_o , Y_o). Otherwise, the method of setting up the starting point O is considered depending on the shape of a recording head. For example, there is also a method to which can specify only the X-axis and can also specify the starting point from other one point, or a certain angle is given to from a specific point, and set the ideal reference point of a recording head, or the device starting point itself is made to correspond. Image-processing detection can attain recognition of each point. With these techniques, a delivery position and an impact position are relatively measurable from the reference part of a recording head in recording head test equipment.

[0098]Subsequently, various kinds of data is measured. Although it is acquirable according to the characteristic which needs a recording head as measurement data, in the test equipment of this example, it has a function which can measure the following items.

- (1) Measurement of a record element position (S47-S48)
- (2) Measurement of a record dot impact position (S49-S51)

These measure points are set up arbitrarily, focusing is made each measure point with the camera 48 for image processing, it observes and the data of each measure point is obtained by carrying out image arithmetic processing. An individual measure point is mentioned later. If in charge of these measurement, it is controlled by a recording control means to be able to carry out record printing of the various recording patterns according to the composition and the characteristic of a recording head, Measurement of a record dot impact position is faced, In [it is desirable to be carried out by the same stable recorded state as record with the usual device main frame, and] S50, After performing record printing of a recording pattern preparatorily and stabilizing a record printing condition in advance of the record dot impact to measure until impact of a record dot is stabilized, it is preferred to make the record dot to measure reach a recording medium. [0099]And in S52, data processing of the measurement data is carried out according to the characteristic which needs a recording head, and it outputs a synthetic judgment to a monitor, a file, etc. In order to make it reflected in a manufacturing installation as manufacturing process data, direct communication can be carried out or it may enable it to access the network within a process. Thus, while getting to know the characteristic of a recording head, it is possible for you to also make it reflected in a manufacturing process. Subsequently, when measuring another recording head (S53), it returns to S43 and duplicate measurement is performed, and when ending measurement, the sequence of measuring finish operation is performed and it ends (S54).

[0100]Hereafter, the individual parameter in the test equipment of this example is explained taking the case of a liquid jet recording head.

[0101]Position measurement (S47-S48 of the flow chart in [drawing 15](#)) of the delivery which is a record element, In the recording head test equipment illustrated to [drawing 13](#), the delivery of the recording head (liquid jet recording head) 41 fixed to the recording head fixture 42, Focusing is carried out with the camera 48 for image processing, and it can observe and can carry out by carrying out image processing, Measurement (S49-S51 of the flow chart in [drawing 15](#)) of the impact position of the drop (ink) which is a record dot, After making a drop breathe out from the delivery of the recording head 41 and making it reach the target on the recording medium 47, it can carry out by carrying out

focusing with the camera 48 for image processing, and observing and carrying out image processing of the impact drop. The regurgitation (S50) of the drop measured in measurement of a drop impact position, It is desirable to be carried out in the same state as the regurgitation of the recording ink in the usual device main frame where it was stabilized, After performing the drop regurgitation of a recording pattern preparatorily and stabilizing the regurgitation until the regurgitation of the drop to measure precedes and the regurgitation of a drop is stabilized, it is preferred to carry out the regurgitation of the drop to measure so that a recording medium may be reached.

[0102]In the case of the recording head which has a row of outlet ports of two rows as the key map which measures the relation of the drop impact position to the position of the delivery of a recording head is illustrated to (a) of drawing 17 and it is shown in (a) of drawing 16, as shown in (b) of drawing 17, it is measurable also in the relative position relation of a row of outlet ports. When a delivery is made into the shape shown by O seal, the main (center of gravity) coordinates are shown by +, and the shape where the slash was given in O shows impact shape.

[0103]Such measurement data has coordinates of the direction of X, and the direction of Y, respectively (in addition). The coordinates of a Z direction can know the relative physical relationship from a certain reference position by the object for a parallel check, For example, the impact position to a delivery position shifts (X and Y), and the data of the relative distance (X and Y) of the delivery position of the 1st row and the 2nd row, the relative distance (X and Y) of the impact position of the 1st row and the 2nd row, etc. is obtained. Thus, since the regurgitation characteristic of a recording head can be checked directly, the data of the discharging angle of a drop, etc. can be obtained from these acquired data. That is, about the discharging angle of a drop, the distance and the delivery between a delivery position and an impact position to a recording medium can compute according to interval distance. By and the thing made to reflect this result in the delivery perforation process of an ink jet recording head when data is obtained, for example in a certain specific form offset by the angle. The manufacturing variation of a process can be canceled, the yield is raised and it becomes possible to manufacture a high-definition recording head by low cost. This cycle is performed periodically, and if operation layout is carried out so that it may be reflected one by one, a self-conclusion type routing system can be built. From now on, while highly minute-ization of a liquid jet recording head progresses further, it will become possible to embody the stable manufacturing process system.

[0104](a) of drawing 18 and (b) are key maps which compare each designed value and actual measurement for the delivery position and drop impact position of a liquid jet recording head. O seal shows a design position and + shows the main (center of gravity) coordinates. The shape where the slash was given in O shows survey shape. The measurement data can have coordinates of the direction of X, and the direction of Y, respectively, and can know the absolute magnitude of variation to a designed value. Since this function can check directly the manufacturing process capability about the delivery position and drop impact position of a liquid jet recording head, if a value of standard is set up, it can perform distinction of OK/NG of a product simply from these acquired data.

[0105](a) of drawing 19 and (b) are key maps which check the delivery as a row of outlet ports of a liquid jet recording head, and the characteristic of an impact position. O seal shows the survey shape of a delivery and an impact position, and + shows the main

(center of gravity) coordinates. The measurement data can have coordinates of the direction of X, and the direction of Y, respectively, and can know the absolute magnitude of variation to the designed value of a row of outlet ports. It has separated only from which from the survey approximation straight lines of the detailed physical relationship for every adjoining delivery or impact position, a row of outlet ports, and an impact position sequence, or statistical operation processing of the maximum, the minimum, etc. is also possible. Since this function can check directly the manufacturing process capability about the delivery position of a liquid jet recording head, if a value of standard is set up, it can perform distinction of OK/NG of a product simply from these acquired data.

[0106](a) of drawing 20 is a parameter characteristic with a special liquid jet recording head, i.e., the key map which checks the relative angle of the impact approximation straight lines of two points and each row of outlet ports absolutely from a reference position. The row of outlet ports of the direction near a reference position shows an impact point required for this measurement to (b) of drawing 20, the shape where the slash was given in O shows impact shape to it, and + shows those main (center of gravity) coordinates to it. In the recording head in which measurement of the relative angle of the impact approximation straight lines of two points and each row of outlet ports has two or more rows of outlet ports absolutely from a reference position, it becomes an important parameter. If this parameter exceeds a value of standard, when it carries a record dot not only not reaching the target in the shape of an ideal lattice but two or more such recording heads in the carriage of a recording device body, it becomes impossible to fill the function as a recorder. This point can have coordinates of the direction of X, and the direction of Y, respectively, and can know the absolute magnitude of variation to the designed value of a row of outlet ports. The angle and sequence center coordinates over a normal coordinate axis in each row of outlet ports are important as an impact target of a recording head. If a value of standard is set up similarly, OK/NG distinction can be performed more simply than these acquired data. Also in which case, if the measurement data to a reference position is acquirable, subsequent required recording head characteristic data acquisition is possible only at data processing.

[0107](The 3rd example) In each example described above, in order that the computed data may apply feedback within the manufacturing process of a recording head, it is used, but it is also possible to record or memorize this data to a liquid jet recording head. Then, in this example, the example of a recording head provided with the data about the discharging angle etc. of the drop computed by the impact-area inspection method of the liquid jet recording head of this invention is explained using drawing 21 thru/or drawing 25.

[0108]Drawing 21 is a figure showing an example which specifies impact-area dispersion on a recording medium. In this example, impact-area ** was defined as a main rank (or regulation center value), and the range before and behind that which can be amended was divided into three ranks. The transverse direction where the rank is set up can be amended by the timing which prints the nozzle corresponding to a head impact area to combine, and the range by which the rank division is carried out is one of the ranges which can be amended by this timing. For example, what is necessary is to assume an impact area when the 1st nozzle eye of the 1st head is printed to be a center value of **, and just to adjust the printing time of onset of the rank difference, when an impact area

where the 2nd head should originally be printed at the same point becomes a position of **.

Of course, the rank division of the impact area of each head may be carried out individually, and timing may be carried out so that all the ranks may become a specific rank position.

[0109]Drawing 22 is a flow chart about the impact rank creation in this example. Before going into this flow chart, the range in which the timing of an impact area is possible is set up, and the rank is beforehand created to the rank of the range which can be amended based on it, and the other rank. The impact-area rank creation flow shown in drawing 22 based on this rank table is started.

[0110]Impact position data is measured with the above-mentioned inspection method (S61), and the rank of the impact position in the optional setting nozzle based on this data is created (S62). ***** [the impact position / in a correction range] is confirmed (S63), and if it is a rank in a correction range, amendment data will be written in a recording head (S64), and it will become normal termination. If an impact position is a rank outside a correction range, since it is NG, abnormal termination will be carried out [not performing writing (S65)], and this recording head will be discharged. It is more desirable to perform feedback to a manufacturing process, as it is moreover in each above-mentioned example.

[0111]Drawing 23 is a block diagram showing the relation between the recording head test equipment in this example, and a recording head. The rank division explained in drawing 22 is performed in the rank division data creation part 65 of the recording head test equipment (impact position measurement) 64 illustrated to drawing 23. The recording head test equipment 64 is provided with the memory control part 66 as a data writing means.

By this memory control part 66, above-mentioned data can be written in the memory (memory measure) 68 on the recording head 67.

It may enable it to read again the data written in if needed from a recording head. Here, as the memory measure 68 of the recording head 67, the cut of the specific pattern on a recording head and the change of state of the semiconductor circuit on a recording head may be used, and memories, such as EEPROM, may be used. What is necessary is just to give the function which can reflect these data in some terminals (an electric connection part with a recorder is desirable) which can communicate with a recording device body (printer body), even if it is which case. Information, including a discharging angle etc., can be given to the recording head 67 by giving the writing means to the memory measure 68 on the recording head 67 to the recording head test equipment 64, without making a manufacturing process complicate so that clearly from this drawing 23.

[0112]Next, the recorder which can carry the recording head mentioned above is explained with reference to drawing 24. Drawing 24 is an outline perspective view showing the liquid jet recorder concerning one embodiment of this invention.

[0113]The liquid jet recorder of this embodiment can carry the recording head cartridge 70 disengageable free [attachment and detachment] for the ink tank 71 for supplying ink to this recording head 67 while being provided with the recording head 67 mentioned above. In the example illustrated to drawing 24, the carriage 72 is equipped with the two recording head cartridges 70 by the mechanism in which it does not illustrate, enabling free attachment and detachment. The carriage 72 is connected to a part of belt 73 stretched by the pulley 74 of the couple which engages with the guide rail 75 slidably,

and is rotated by an unillustrated motor. Thereby, the carriage 72 becomes movable [which met the guide rail 75]. By conveying the recording form as recorded media the specified quantity every by an unillustrated paper handling mechanism, and performing the scan of the recording head by movement of a carriage for every conveyance of this recording form, record of a picture etc. is made in the record paper and it goes by the lower part of the carriage 72. 76 is a flexible cable and is for performing image data transmission to a recording head, etc. At the end of the moving range of the carriage 72, the field in which the regurgitation recovery unit 77 was formed, for example, the delivery of each recording head was allocated by the cap 78 can be covered.

[0114]Drawing 25 is a block diagram showing the composition of the control circuit of the recorder shown in above-mentioned drawing 24. In drawing 25, ROM which stores the control program with which MPU performs the interface whose 100 inputs a record signal, and 101, and MPU101 performs 102, and 103 are DRAMs which save various data (record data supplied to the above-mentioned record signal or the recording head 67). 104 is a gate array (G. A.) which performs supply control of the record data to the recording head 67, and also performs data transfer control between the interface 100, MPU101, and DRAM103. The head driver with which 105 drives the recording head 67, and 106 and 107 are Motor Driver for driving the feed motor 110 and the carriage motor 111, respectively. And 109 is a reading means for reading the contents of the memory measures 68, such as a memory of the recording head 67. When creating the rank data of the above-mentioned recording head 67 externally through MPU101 or an interface from the read data, this reading means may be an electric connection part with a mere recording head.

[0115]Explanation of operation of the above-mentioned control circuit will read the rank data of the recording head 67 in the memory measures 68, such as a memory etc. of the recording head 67 with which the recorder was equipped, by the reading means 109. And if a record signal goes into the interface 100, a record signal will be changed into the record data for a print between the gate array 104 and MPU101. At this time, data is amended so that the optimal discharging timing for the recording head with which it has equipped based on the read above-mentioned rank data now may be adjusted. And while Motor Driver 106 and 107 drives, the recording head 67 drives according to the record data sent to the head driver 105, and record is performed. The information on the memory 68 in the above-mentioned recording head 67 becomes what was reflected in discharging timing etc., and the drive of the recording head at this time can perform high-definition record by preventing an impact-area position gap compared with the case where such amendment is not performed.

[0116]In a recorder, the timing which reads the rank data of a recording head, and its method can set up arbitrarily the time of the attachment to the device of a recording head, and printing execution, etc. in accordance with the composition of a recorder.

[0117]Although the example about the impact-area position gap with the 1st head and the 2nd head explained in above-mentioned explanation, it cannot be overemphasized that it is applicable also in two or more combination. It is not influenced by the gestalt of the memory measure provided in the recording head, either. Anyway, the recorder without an impact-area position gap of a combination head which can perform high-definition record can be provided by this example.

[0118]In addition, when not amending discharging timing etc. according to the recorder

of this example, even if it is a recording head which some impact-area position gap produces. Since the impact-area position gap is correctable by amending the discharging timing by the recorder side at the time of the regurgitation, it is effective in the ability to raise the yield of a recording head. Since the recording head of this example is beforehand provided with the data for amendment of an impact-area position, when it equips a recorder with a recording head, it also has an advantage of it becoming unnecessary for a user to print the check pattern for impact-area position amendment.

[0119]

[Effect of the Invention]. [how many impact positions as explained above, according to this invention, have shifted to the picture element position where the drop breathed out from a liquid jet recording head was decided, and] The discharging angles of the main drop which checks whether the position of a delivery is still more proper, and constitutes a drop, and a satellite can be measured. In the case where the impact position has shifted to the picture element position decided when a satellite was observed in a recording medium etc., it becomes possible to feed back quickly that a delivery formation angle should be changed into the manufacturing process of a liquid jet recording head. By this, it can be measured, the computed data can be made to be able to reflect in the manufacturing process of a recording head promptly, it can become possible to manufacture a high-definition recording head, and the yield of a product can be raised greatly. According to this invention, a recording head can be inspected without printing with a recording device body, and further, what is necessary is just to use the recording medium of the degree of necessary minimum, and it becomes an inspection system [ecology / inspection system / present].

[0120]In this invention, it can inspect to the relative recorded state in the same mode as the time of attachment of the recording head to the carriage of a device main frame by carrying out image processing of the record dot recorded by printing control, where a recording head is fixed with the same recording head contact mechanism as a recording device body.

Therefore, with a recording head simple substance, it is measurable in the amount of relative gaps and the amount of absolute gaps on an unclear recording device body. In other recording heads, such measurement data can be measured as printing impact performance as drop impact performance in a liquid jet recording head, and it is high resolution and it makes it possible to data-ize printing quality of a high definition recorder directly.

[0121]The amount of impact gaps of a recording head element can be measured from the physical relationship of the measured record dot and the record element corresponding to it, since the data about this amount of gaps is utilizable as data made to reflect in a head manufacturing installation (the case of a liquid jet recording head delivery manufacturing installation) suitably -- high resolution -- and a high definition recording head is establishable by a manufacturing stage. As a result, the recording head which does not need the picture gap adjustment in a recorder, etc. can be provided.

[0122]This invention presents the above effects and is not influenced by the kind or resolution of a recording head. Especially the viewpoint on a liquid jet recording head and of drop impact performance is an important parameter, and the effect which can measure this directly and can reflect data by a manufacturing stage is greatest. For example, by the delivery work process of a liquid jet recording head, if it manufactures

based on these data, it will become possible to provide the liquid jet recording head which attained the uniform impact performance. thus, high resolution -- and a self-conclusion type manufacturing system can be built as the inspection for providing a commercial scene with a high-definition recorder by low cost, and a manufacturing method, and the effect is greatest.

[0123]By making the recording head record or memorize the data about discharging angle information, an impact-area position gap, etc. which were measured by a recording head inspection method and test equipment, and were computed, This data is read in a recording head at the time of wearing to the recorder of a recording head, and printing execution, etc., It can become possible to perform amendment and adjustment of discharging timing etc. at the time of printing execution, and to perform printing which does not have an impact-area position gap at the optimal discharging timing for each recording head, and record, and the yield of a recording head can be raised greatly.

[Translation done.]